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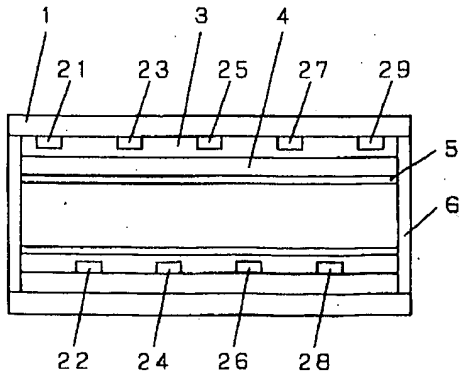
(54)【発明の名称】　低圧放電ランプ

(57)【要約】
【課題】　平板型希ガス放電ランプの構造及び点灯制御方法を特定して、紫外放射効率、及び蛍光体を介しての可視放射効率の極大化をはかること。
【解決手段】　複数の電極２１～２９とそれを被膜する誘電体３並びに酸化マグネシウム膜４を有したガラス基板１を相対向させ、これに制御パルス発生装置により複数の電極に個別に位相差パルス電位を印加することによって、希ガスの効率的な発光を促す最適点灯制御を行う。

1　ガラス基板
3　誘電体
4　MgO膜
5　蛍光体
6　基板支持枠
21,22,23,24,25,26,27,28,29　電極



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INOHARA MAKOTO
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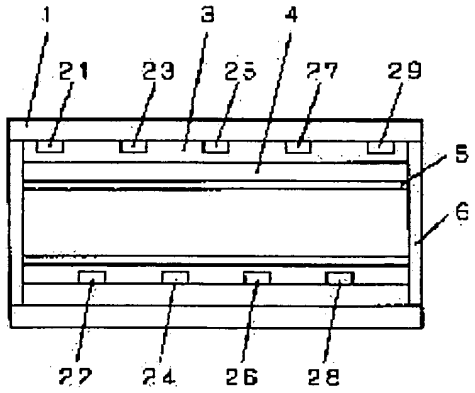
MATSUOKA TOMIZO

(54) LOW PRESSURE DISCHARGE LAMP

(57)Abstract:
PROBLEM TO BE SOLVED: To specify a structure of a flat rare gas discharge lamp and a lighting controlling method, thus maximizing ultraviolet radiation efficiency and visible radiation efficiency via phosphor.
SOLUTION: A plurality of electrodes 21 to 29 and a glass substrate 1 having dielectric 3 coating the electrodes 21 to 29 and a magnesium oxide film held between dielectric 3 and phosphor 5 covering dielectric 3 are faced to each other. Phase difference pulse potential is individually applied on the plurality of electrodes 21 to 29 by a control pulse generator. As a result, an optimum lighting control urging efficient luminescence of rare gas is performed.



LEGAL STATUS

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[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

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CLAIMS

[Claim(s)]
[Claim 1] A low-pressure discharge lamp which it has a wrap fluorescent substance, and a component on these glass substrates is countered and installed [dielectric / a wrap dielectric and / said] by substrate housing on a glass substrate in two or more electrodes installed in parallel, and said electrode, and carries out pulse burning of the enclosure rare gas.
[Claim 2] A low-pressure discharge lamp according to claim 1 which comes to insert a MgO film between a dielectric and a fluorescent substance.
[Claim 3] A low-pressure discharge lamp according to claim 1 which it comes to drive with two pulse voltage which the length direction of an electrode on a glass substrate is mutually parallel at the two electrodes which sandwiched a substrate housing, and carries out phase inversion about the eventh to the oddth among array electrodes of each substrate.
[Claim 4] A low-pressure discharge lamp according to claim 1 which it comes to drive with a phase which an electrode on a glass substrate which counters on both sides of a substrate housing takes a configuration of alternate arrangement mutually, is in a cadaveric position phase of an electrode which is two which a phase of a certain electrode counters, and shifted **1/4 to a phase of said two electrodes.
[Claim 5] A low-pressure discharge lamp according to claim 1 which it comes to drive with two pulse voltage which the length direction of an electrode on a glass substrate which counters on both sides of a substrate housing intersects perpendicularly mutually, and carries out phase inversion about the eventh to the oddth among array electrodes of each substrate.
[Claim 6] A low-pressure discharge lamp according to claim 5 which it comes to drive with a phase which a phase of a pulse impressed to an electrode which counters and intersects perpendicularly on both sides of a substrate housing shifted **1/4 mutually between counterelectrodes.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to a low-pressure discharge lamp gentle to earth environment.
[0002]
[Description of the Prior Art] compared with the lamp containing mercury, the discharge lamp containing mixed rare gas, i.e., a rare-gas discharge lamp, has alike and low luminous efficiency among low-pressure discharge lamps. However, the advantage of this rare-gas discharge lamp is that it does not unite with the remarkable temperature characteristic which is the defect of a mercury enclosure lamp. For this reason, it is used for the light source of which is not influenced by fluctuation of ambient temperature but a fixed optical output is always required like the light sources for information reading, such as a copying machine and facsimile, or a liquid crystal back light in many cases. Moreover, since this rare-gas discharge lamp does not contain mercury, it is attracting attention also from the so-called viewpoint of "earth environmental protection."
[0003] The means for raising this luminous efficiency can reinforce the ultraviolet-radiation bunch which rare gas emits how, can change the light from that ultraviolet radiation efficiently [how] through a fluorescent substance, or can divide it roughly into two points of **.
[0004] Among these, it is known from the former that the burning method by the square wave is superior to the burning method by the sine wave by making the former ultraviolet-radiation bunch into a means to emit light efficiently. Moreover, efforts to achieve optimization are continued also about frequency by making a tube length, a class, gas pressure of filler gas, etc. into a parameter. [the tube diameter of the discharge tube,]
[0005] For example, although there are many examples which pulse width and its duty ratio are changed according to a bulb item or a filler gas property, and are calculating the maximal value so that it may be represented with JP,2-174097,A etc., the luminous efficiency is low compared with the lamp for general lighting, and the room of amelioration is left behind. moreover, the plate mold light source -- aiming -- the conductor of plurality [one side] -- although the example which installed the electrode and the dielectric film is indicated, the actual condition is being unable to use it as an object for general lighting because of the low luminous efficiency like the above.
[0006]
[Problem(s) to be Solved by the Invention] The technical problem which this invention tends to solve improves the discharge property of a rare-gas discharge lamp, realizes ultraviolet region luminescence efficient [how], and is to find out an efficient burning method.
[0007]
[Means for Solving the Problem] In order to solve this technical problem, in this invention, an optimal burning control method of urging efficient luminescence of rare gas by impressing pulse potential is found out according to an individual to an electrode of ** Li plurality [this / generator / control pulse] by making a dielectric film list which carries out the coat of it to two or more electrodes carry out phase opposite of the substrate with a magnesium-oxide film.
[0008]
[Embodiment of the Invention] Below, the example of this invention is explained.
[0009] Drawing 1 shows the 1st example of this invention, keeps fixed distance from a glass substrate 1, and electrodes 21, 23, 25, 27, and 29 are installed in parallel. These electrodes are lines and are created by the ITO film or the metal (silver) film. On the above-mentioned glass substrate 1, as a dielectric 3 covers an electrode, it is applied, and it is further applied in order of a MgO film and a fluorescent substance on it.
[0010] Drawing 1 is the discharge lamp which separated two substrates with such a configuration by the substrate housing 6, and was made to counter parallel, and the rare gas represented with Xe gas etc. is enclosed in the substrate.
[0011] In such a discharge lamp, an electrode 21, an electrode 22, the dielectric barrier discharge that minded each dielectric when voltage was further impressed between the electrode 23 and the electrode 24, or silent discharge occurs. Generally, Xe atom at the time of low voltage discharge of Xe gas is excited by the energy levels which Xe*, Xe**, or Xe+ has according to the electrical energy to supply, and the 147nm radiation which is the resonance line which results in the ground level of Xe from Xe* is observed as main atom luminescence.
[0012] However, in the case of the former, if superfluous electrical energy is supplied for a short time or electrical energy is continuously supplied to it in this excitation process, the energy loss by for example, the ambipolar diffusion from ionized Xe, and the neutral atom and molecular collision in transition processes other than the resonance line increases, and also when it is the latter, the same loss as the former by buildup of electron density will arise. It becomes important, when supplying the electrical energy of the level of the degree which exceeds suitable energy levels, for example, Xe*, slightly by this for a short time, and supplying the following electrical energy through a fixed idle period raises luminous efficiency.
[0013] On the other hand, in two atomic molecules of Xe2, through the energy levels of Xe*, two atomic molecules are constituted, it shifts to Xe2* of low level, and molecule luminescence (172nm and 158nm), i.e., excimer luminescence, is mainly observed from Xe*.
[0014] While supplying the electrical energy of the level of the degree which exceeds Xe* slightly also in this case to the short time of the degree to which electron density does not increase, it becomes important on the improvement in effectiveness to maintain the low electron density which controls the excitation to the level of Xe2** as much as possible.
[0015] The above-mentioned silent discharge suits such discharge conditions well, for example, as for the size of a discharge pillar, in the case of the gas pressure of a below atmospheric pressure degree, a discharge gap is observed by about 100-micrometer order by about 1000 micrometers.
[0016] In this example, although it generates at random in general silent discharge, if this discharge part thru/or a discharging point can be

limited on a parallel pole and distance with a contiguity electrode is optimized to about 100 micrometers, it can reduce the energy-loss by buildup of electron density, raising the density of a discharging point, and can increase the effectiveness of excimer luminescence compared with the case of random generating.
[0017] Here, a MgO film has the role which lowers the discharge voltage which increases compared with a whole surface electrode method. Moreover, a fluorescent substance 5 prepares for example, europium activation ulmin acid barium (blue), zinc silicate manganese (green), and europium activation yttrium oxide (red), and presents white luminescence, and the quantum efficiency at the time of setting three sorts of fluorescent substances becomes high by 172nm rather than 147nm in this way.
[0018] Thereby, luminous efficiency (lm/W) increases [the direction which changes luminescence at the time of Xe discharge in gases into 2 atomic-molecule luminescence, i.e., 172nm luminescence, from 147nm atomic luminescence]. Moreover, about a burning method, in the standup at the time of sinusoidal burning, and the time zone of falling, since applied voltage is low, generating of silent discharge decreases. For this reason, rather than sinusoidal burning, the probability for silent discharge to happen [the direction of square wave burning] becomes high, and the whole luminous efficiency rises.
[0019] In drawing 1 , it arranges so that an up-and-down electrode may serve as alternate arrangement, and the voltage to each electrode is controlled like drawing 2 , and is impressed. namely, the pulse voltage from which a phase differs -- four sorts -- preparing -- the upside electrodes 21 and 25 of drawing 1 -- the pulse voltage of phi 1 -- 23 of an upside electrode and 27 -- phi 3 and the bottom electrodes 22 and 26 -- phi 2 and the bottom electrodes 24 and 28 -- the pulse of phi 3 is impressed to --, respectively. [moreover,]
[0020] Drawing 1 expresses the Time Flo-chart of such pulse voltage, and (a) expresses a discharge path [in / for the relative position and pulse impression schematics of an electrode / in (b) / applied voltage and each time of day]. In (b), it discharges with electrodes 21 and 22 and electrodes 23 and 24 in the section of time of day t10. The slash section of a rhombus expresses the discharge path.
[0021] Similarly, at time of day t11, it discharges, respectively with electrodes 20 (not shown) and 21, electrodes 22 and 23, and electrodes 24 and 25. When these actuation is summarized, another expression is taken and it is in the cadaveric position phase of the electrode which is two which the phase of a certain electrode counters, it turns out that it is driving with the phase shifted **1/4 to the phase of said two electrodes.
[0022] Moreover, it turns out that the discharge path is moved from the electrode 23 to an electrode 21, maintaining H level in time of day t11 and t20, if an electrode 22 is observed. Moreover, it turns out that the discharge path is moved from the electrode 23 to an electrode 21, maintaining L level in time of day t21 and t30. Thus, the discharge environment of silent discharge can be prepared to stability and homogeneity by fixing one side of each discharge path and changing the polarity of discharge for another side by turns simultaneously with a switch.
[0023] Moreover, in such alternate electrode structure, when the panel of drawing 1 is seen from right above [the] or right under, the brightness on the appearance which a discharge pillar doubles a radix point with each up-and-down electrode, and minds an inclination and a fluorescent substance aslant rises. Furthermore, when atomic luminescence progresses a discharge sky period, to seeing in response to the big self-absorption for that line spectrum, and the upper brightness falling, luminescence of two atomic molecules has an extraordinarily small self-absorption in order to present narrow-band luminescence centering on 172nm, for this reason the ultraviolet rays which reach a fluorescent substance side increase, and the luminescence brightness of the above-mentioned panel increases by leaps and bounds.
[0024] Although the above-mentioned example has explained the case where the electrode which counters is parallel, the 2nd example is given and explained about the case where a counterelectrode intersects perpendicularly. Drawing 3 is what expressed the electrode of a panel superficially, and the line of length and width expressed the electrode and has countered with the up-and-down substrate. At this time, each intersection in every direction turns into a discharging point.
[0025] Although now impressed by the electrode in every direction by turns at the voltage of H, L, H, and L, the impression pattern is set to P1 and P2 about a horizontal electrode like drawing 3 , and it sets up with P3 and P4 about a vertical electrode. Now, the impression pattern of a horizontal electrode is set to P1, using the impression pattern of a vertical electrode as P3 in time of day t1. At this time, it discharges on the intersection of a round mark.
[0026] Next, if the impression pattern of a horizontal electrode is changed from P1 to P2 in time of day t2, discharge on the intersection of a round mark will stop and will discharge on the intersection of x mark. Furthermore, if a vertical electrode is switched to P4 from P3 in time of day t3, discharge with x mark will discharge on the intersection of a stop round mark.
[0027] However, it turns out that the polarity of discharge is last time reversed compared with the time of discharge of the round mark in time of day t1. Furthermore, if a horizontal electrode is switched to P1 from P2 in time of day t4, the discharge by the round mark will stop and the last time of day t2 and discharge with reverse potential will produce it by x mark.
[0028] moreover, even if it is the same round mark thru/or x mark, aslant, even when it is the same, the direction of discharge will be reversed to each other, and, on the other hand, discharge of this direction will produce discharge time of day at this time of day every other every direction. Actuation [in / for the further above-mentioned actuation / the intersection of a double circle and a triangle] is taken for an example among the electrodes of drawing 3 in every direction, and it explains using the Time Flo-chart of the pulse voltage impressed to this.
[0029] In drawing 4 , at the discharging point of a double circle, it discharges, as the rhombus containing a slash shows at time of day t1 and t3, and it turns out that the polarity is reversed. With a triangular discharging point, it turns out similarly at time of day t2 and t4 that polarity is changed and it is discharging.
[0030] Thus, by dividing a vertical electrode and a horizontal electrode into an odd number electrode and an even number electrode, impressing the pulse signal which carried out phase inversion to the extent that it was mutual to these, and shifting the phase contrast of a vertical electrode and a horizontal electrode 1/4 further, as shown in drawing 3 , slanting grid-like discharging points come to shift to right and left or the upper and lower sides all at once seemingly.
[0031] Thus, by switching the potential of each electrode with two or more phases, the discharging point which silent discharge produces is controllable in the shape of a matrix. Although it generates at random in general silent discharge, in this example, a discharging point will stop discharge at four discharging points of the perimeter under discharge in every discharging point, in being able to limit an electrode intersection in the shape of a slanting grid, and can prepare the discharge environment of silent discharge to stability and homogeneity.
[0032] Furthermore, if the inter-electrode distance which counters, and contiguity inter-electrode distance are optimized, the energy-loss by buildup of electron density can be reduced raising the density of a discharging point, and the effectiveness of excimer luminescence can be increased compared with the case of random generating.
[0033] In addition, above, although the low-pressure discharge lamp of a plate mold has been explained, if a light reflex film is given to either of the glass substrates on the back, light can be easily taken out only from one side of a plate. if the above-mentioned plate is furthermore bent and it is made the shape of a cylinder -- present -- the form of the straight pipe fluorescent lamp of business is approached.
[0034] In this case, a bulb serves as a double pipe, a light reflex film is prepared in the inner-tube inside, and the combination of spiral

electrodes, or a spiral electrode and the straight-line electrode of the direction of a tube diameter can combine an electrode with the outer-tube inside and an inner-tube outside, it can be further installed with gestalten, such as combination of straight-line electrodes, and can be manufactured easily. The pulse burning circuit furthermore impressed to an electrode using the hollow inside an inner tube can be contained, and there are many practical advantages.

[0035]

[Effect of the Invention] Excimer light can be taken out to the maximum extent by impressing two or more pulses from which a phase differs according to the conformation of two or more counterelectrodes suitable for a corresponding electrode, in case a plate mold low voltage rare-gas discharge lamp is turned on according to this invention as mentioned above, it can change into the light efficiently through the fluorescent substance which can expect the quantum efficiency higher than 147nm in a long wavelength ultraviolet region when it is Xe discharge in gases, and the value in an industrial application side is large.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing showing the structure of the low-pressure discharge lamp in the example of this invention
[Drawing 2] The flow chart of the impression pulse in the 1st example of (a) and (b) this invention
[Drawing 3] Drawing showing the applied-voltage pattern to the electrode by the 2nd example of this invention
[Drawing 4] The flow chart of the impression pulse by the 2nd example of this invention
[Description of Notations]
1 Glass Substrate
3 Dielectric
4 Magnesium-Oxide (MgO) Film
5 Fluorescent Substance
6 Substrate Housing
21-29 Electrode

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DRAWINGS

[Drawing 1]

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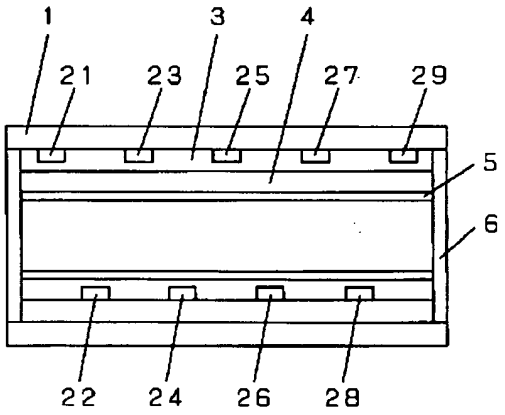
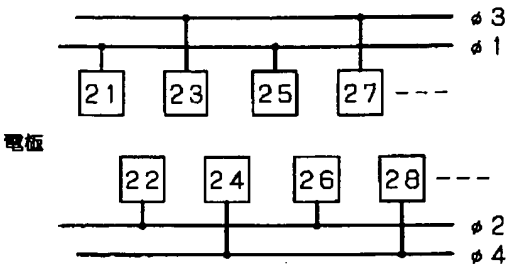
3 誘電体
4 MgO膜
5 蛍光体
6 基板支持枠
21,22,23,24,25,26,27,28,29 電極



[Drawing 2]

(a)



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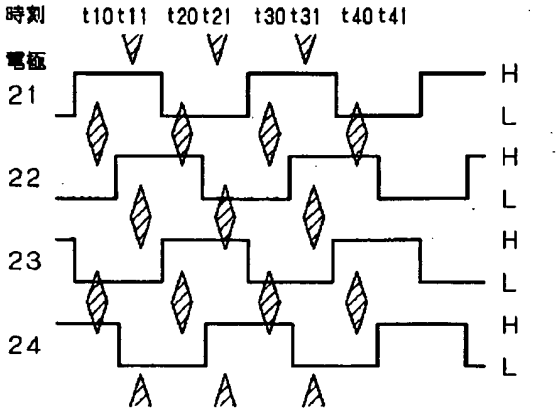

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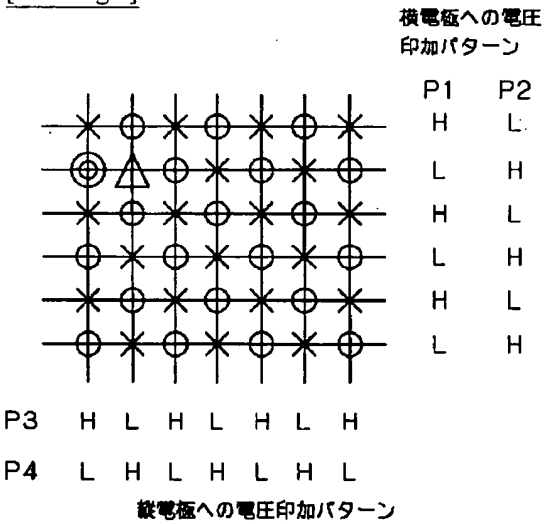

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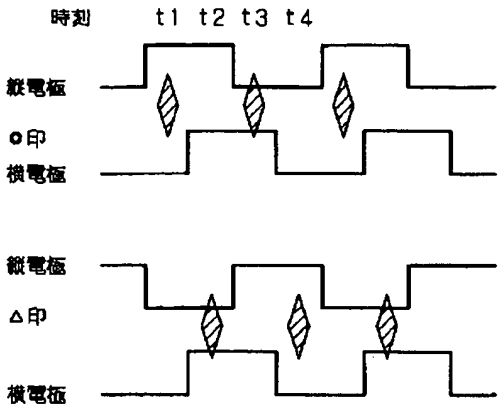

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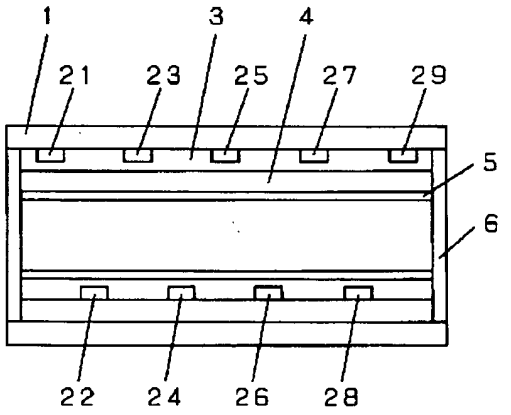
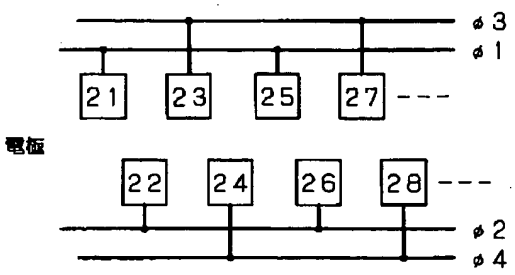


[Drawing 2]

(a)



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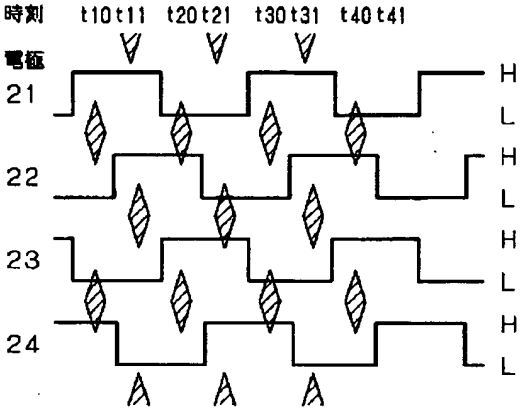

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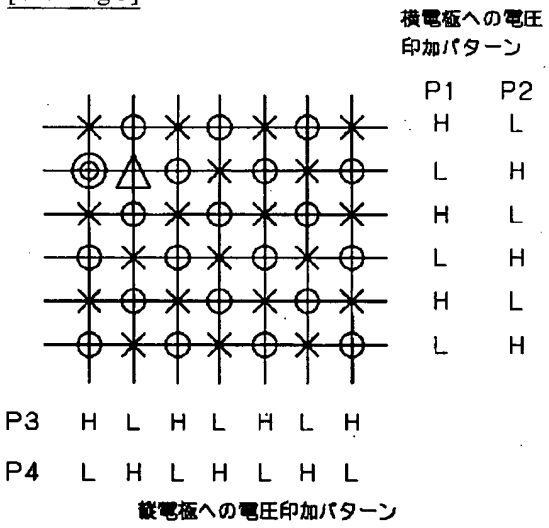

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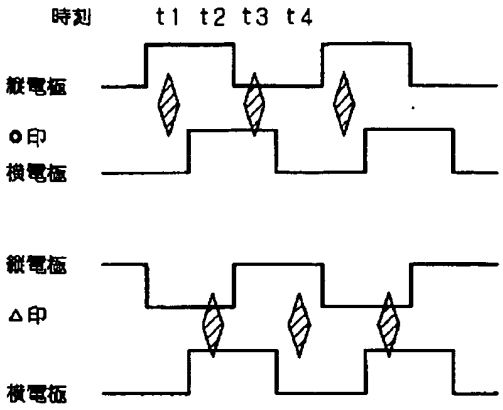

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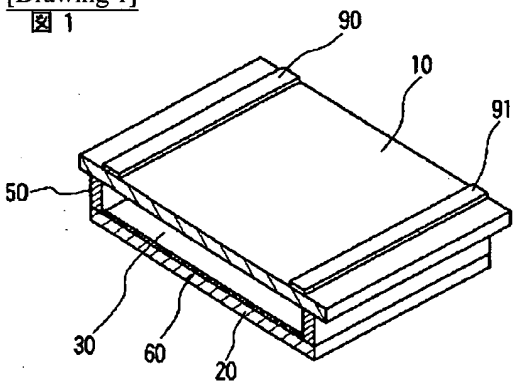
DRAWINGS

[Drawing 1]
図 1



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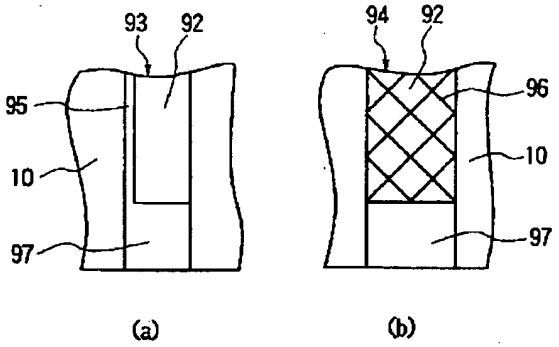
50･･･側板
60･･･蛍光体
90･･･放電電極
91･･･放電電極

[Drawing 2]
図 2



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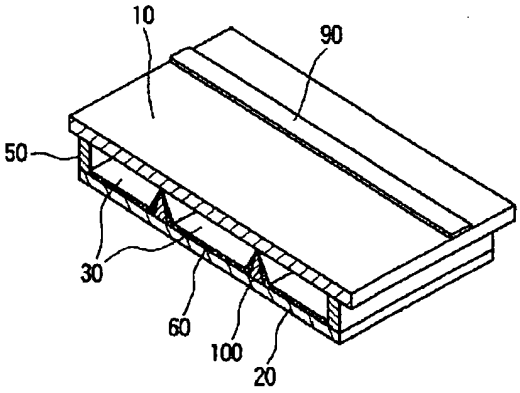
96･･･金属導体

[Drawing 3]

図 3



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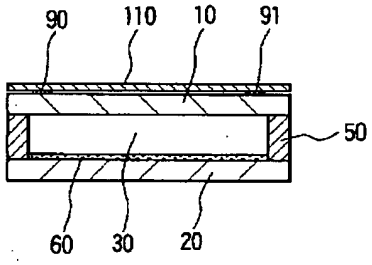
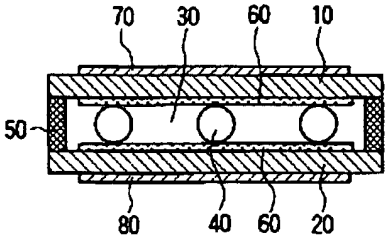
90･･･放電電極
100･･･スペーサ

[Drawing 4]
図 4



10･･･前面板
20･･･絶縁基板
50･･･側板
60･･･蛍光体
90･･･放電電極
91･･･放電電極
110･･･絶縁シート

[Drawing 5]
図 5



[Translation done.]